

What is claimed is:

1 A virtual output queuing controlling device
comprising:

5 a class information allocation section;
 a CBR class bandwidth management section;
 K class bandwidth management sections (K is a positive
integral that is one or more);

10 a connection request generation section; and
 a cell read-out controlling section,
 wherein said class information allocation section
allocates received class information of each cell to one
class bandwidth management section out of said class
bandwidth management sections,

15 wherein said CBR class bandwidth management section
measures the cell number of a CBR class, and
 wherein, based on the received class information, said
class bandwidth management sections determine conformance
or non-conformance cell by cell, and measure the

20 conforming cell number or non-conforming cell number by
classes, and

 wherein, based on the cell number of said CBR class, the
total conforming cell number of each class, and the total
non-conforming cell number of each class, said connection
25 request generation section generates connection request to

a switch scheduler, and

wherein said cell read-out controlling section is a section that decides which cells are to be read out when connection permission is received from said switch

5 scheduler, based on the conforming cell number and the non-conforming cell number of said CBR class bandwidth management section and each of said class bandwidth management sections.

10 2 The virtual output queuing controlling device according to claim 1, characterized in that said cell read-out controlling section is a section that:

in the event that either the conforming cell or the non-conforming cell was included in the received CBR class,

15 selects said CBR class;

and subtracts one from the conforming cell number in said CBR class.

3 The virtual output queuing controlling device according to claim 1, characterized in that said connection request generation section is a section that:

in the even that said CBR class was received, adds the cell number of said CBR class;

in the event that the cell number of said CBR class
25 exceeded a predetermined value, notifies connection

request with a first priority to said switch scheduler;
and

subtracts only said predetermined value from the cell
number of said CBR class.

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4 The virtual output queuing controlling device
according to claim 1, characterized in that: said class
bandwidth management sections are sections that:

in the even that said CBR class was not received and yet
10 that remaining credit of an assurance bandwidth portion is
one or more, add the conforming cell number and the total
conforming cell in its class; and

said connection request generation section that is a
section that:

15 in the event that said total conforming cell number
exceeded a predetermined value, notifies connection
request with a second priority to said switch scheduler;
and

subtracts only said predetermined value from said total
20 conforming cell number.

5 The virtual output queuing controlling device
according to claim 1, characterized in that:

said class bandwidth management sections are sections
25 that, in the even that said CBR class was not received and

yet that a remaining credit of an assurance bandwidth portion is below one, add the non-conforming cell number and the total non-conforming cell number in its class; and said connection request generation section that is a

5 section that:

in the event that said total non-conforming cell number exceeded a predetermined value, notifies connection request with a third priority to said switch scheduler; and

10 subtracts only said predetermined value from said total non-conforming cell number.

6 The virtual output queuing controlling device according to claim 1, characterized in that said cell
15 read-out controlling section is a section that selects the cells to be sent in order of the cell of said CBR class, the conforming cell, and the non-conforming cell.

7 A virtual output queuing controlling device
20 comprising:

a class information allocation section;

a CBR class bandwidth management section;

K class bandwidth management sections (K is a positive integral that is one or more);

25 a connection request generation section; and

a cell read-out controlling section,

wherein said class information allocation section
allocates received class information of each cell to one
class bandwidth management section of said class bandwidth
5 management sections, and

wherein said CBR class bandwidth management section
measures the cell number of a CBR class, and

wherein, based on the received class information, said
class bandwidth management sections determine conformance
10 or non-conformance cell by cell, and measure the
conforming cell number or non-conforming cell number for
each class, and

wherein, based on the cell number of the conforming cell
in said CBR class bandwidth management section and each of
15 said class bandwidth management sections, and the total
number of the non-conforming cell of each class, said
connection request generation section generates connection
request to a switch scheduler, and

wherein said cell read-out controlling section is a
20 section that, based on the conforming cell number and the
non-conforming cell number of said CBR class bandwidth
management section and each of said class bandwidth
management sections, decides which cells are to be read
out when connection permission was received from said
25 switch scheduler.

8 The virtual output queuing controlling device
according to claim 7, characterized in that said cell
read-out controlling section is a section that:

5 in the event that either the conforming cell or the non-
conforming cell was included in the received CBR class,
selects said CBR class; and

 subtracts one from the conforming cell number in said
CBR class.

10

9 The virtual output queuing controlling device
according to claim 7, characterized in that said
connection request generation section is a section that:

15 in the even that said CBR class was received, adds the
cell number of said CBR class;

 in the event that the cell number of said conforming
cell exceeded a predetermined value, notifies connection
request with a first priority to said switch scheduler;
and

20 subtracts only said predetermined value from said total
conforming cell number.

10 The virtual output queuing controlling device
according to claim 7, characterized in that:

25 said class bandwidth management sections are sections

that, in the even that said CBR class was not received and yet that remaining credit of an assurance bandwidth portion is one or more, add the conforming cell number and the total conforming cell number in its class; and

5 said connection request generation section that is a section that:

in the event that said total conforming cell number exceeded a predetermined value, notifies connection request with a first priority to said switch scheduler;

10 and

subtracts only said predetermined value from said total conforming cell number.

11 The virtual output queuing controlling device
15 according to claim 7, characterized in that:

said class bandwidth management sections are sections that, in the even that said CBR class was not received and yet that a remaining credit of an assurance bandwidth portion is below one, add the non-conforming cell number

20 and the total non-conforming cell number in its class; and

said connection request generation section that is a section that:

in the event that said total non-conforming cell number exceeded a predetermined value notifies connection request

25 with a second priority to said switch scheduler; and

subtracts only said predetermined value from said total non-conforming cell number.

12 The virtual output queuing controlling device
5 according to claim 7, characterized in that said cell read-out controlling section is a section that selects the cells to be sent in order of the cell of said CBR class, the conforming cell, and the non-conforming cell.

10 13 A virtual output queuing controlling device comprising:

 a class information allocation section;
 a CBR class bandwidth management section;
 K class bandwidth management sections (K is a positive
15 integral that is one or more);
 a connection request generation section; and
 a cell read-out controlling section,
 wherein said class information allocation section allocates received class information of each cell to one
20 class bandwidth management section out of said class bandwidth management sections, and
 wherein said CBR class bandwidth management section measures the cell number of a CBR class, and
 wherein, based on the received class information, said
25 class bandwidth management sections determine conformance

or non-conformance cell by cell, and measure the
conforming cell number or non-conforming cell number by
classes, and

wherein, based on the total number of the conforming
5 cell and the total number of the non-conforming cell of
each class including said CBR class, said connection
request generation section generates connection request to
a switch scheduler, and

wherein said cell read-out controlling section is a
10 section that, based on the conforming cell number and the
non-conforming cell number of said CBR class bandwidth
management section and each of said class bandwidth
management sections, decides which cells are to be read
out when connection permission was received from said
15 switch scheduler, and

wherein said cell read-out controlling section is a
section that selects the cells to be sent in order of the
cell of said CBR class, the conforming cell, and the non-
conforming cell.

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14 The virtual output queuing controlling device
according to claim 13, characterized in that said cell
read-out controlling section is a section that:

in the event that either the conforming cell or the non-
25 conforming cell was included in the received CBR class,

selects said CBR class;

in the event that said CBR class is a class that includes the conforming cell, subtracts one from the conforming cell number; and

5 in the event that said CBR class is a class that includes the non-conforming cell, subtracts one from the non-conforming cell number.

15 The virtual output queuing controlling device
10 according to claim 13, characterized in that said cell read-out controlling section is a section that:

in the event that the conforming cell was included in the received CBR class, selects said CBR class; and

subtracts one from the count number of the conforming
15 cell in the said CBR class.

16 The virtual output queuing controlling device
according to claim 13, characterized in that said CBR
class bandwidth management section and each of said class
20 bandwidth management sections have an identical
configuration.

17 The virtual output queuing controlling device
according to claim 13, characterized in that said
25 connection request generation section is a section that:

in the even that said CBR class was received, adds the cell number of said CBR class;

in the event that the cell number of said CBR class exceeded a predetermined value, notifies connection
5 request with a first priority to said switch scheduler;
and

subtracts only said predetermined value from the total number of said CBR class.

10 18 The virtual output queuing controlling device according to claim 13, characterized in that: said class bandwidth management sections are sections that,

in the even that said CBR class was not received and yet that a remaining credit of an assurance bandwidth portion
15 is one or more, add the conforming cell number and the total conforming cell number in its class; and

said connection request generation section that is a section that:

in the event that said total conforming cell number
20 exceeded a predetermined value, notifies connection request with a second priority to said switch scheduler;
and

subtracts only said predetermined value from said total conforming cell number.

19 The virtual output queuing controlling device according to claim 13, characterized in that: said class bandwidth management sections are sections that,

in the even that said CBR class was not received and yet
5 that a remaining credit of an assurance bandwidth portion is below one, add the non-conforming cell number and the total non-conforming cell number in its class; and

said connection request generation section that is a section that:

10 in the event that said total non-conforming cell number exceeded a predetermined value, notifies connection request with a third priority to said switch scheduler; and

subtracts only said predetermined value from said total
15 non-conforming cell number.

20 A virtual output queuing controlling device in an input buffering switch with a virtual output queuing technique, comprising:

20 a specialized class for a CBR traffic; and
a connection request generation section that makes connection request for a switch scheduler, which can execute three-step priority control, characterized in that said connection request generation section makes
25 connection request of said specialized class for a CBR

traffic prior to the connection request of the other classes for said switch scheduler.

21 A virtual output queuing controlling device in an
5 input buffering switch with a virtual output queuing technique, comprising:

a first specialized class for a CBR traffic;

a second class for the other traffics than the CBR traffic;

10 a cell read-out controlling section that reads out the cells from each of said classes; and

a connection request generation section that makes connection request for a switch scheduler, which can execute two-step priority control, characterized in that,
15 when said connection request generation section received connection request from said switch scheduler, said cell read-out controlling section is a section that reads out the cells from said first class prior to said second class.

20 22 The virtual output queuing controlling device according to claim 21, further comprising:

a first counter that measures the cell number in said first class; and

a second counter that measures the cell number in said
25 second class, characterized in that said connection

request generation section is a section that makes connection request for said switch scheduler, responding to the cell number that said first counter and said second counter measured.

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23 The virtual output queuing controlling device according to claim 21, characterized in that said cell read-out controlling section is a section that makes bandwidth determination for both of said first class and said second class, and responding to its result, reads out the cells from said first class when said connection permission was received.

24 The input buffering switch comprising:
15 a class information allocation section;
a CBR class bandwidth management section;
K class bandwidth management sections (K is a positive integral that is one or more);
a connection request generation section; and
20 a cell read-out controlling section,
wherein said class information allocation section allocates received class information of each cell to one class bandwidth management section out of said class bandwidth management sections,
25 wherein said CBR class bandwidth management section

measures the cell number of a CBR class, and

wherein, based on the received class information, said class bandwidth management sections determine conformance or non-conformance cell by cell, and measure the

5 conforming cell number or non-conforming cell number by classes, and

wherein, based on the cell number of said CBR class, the total conforming cell number of each class, and the total non-conforming cell number of each class, said connection
10 request generation section generates connection request to a switch scheduler, and

wherein said cell read-out controlling section is a section that decides which cells are to be read out when connection permission is received from said switch
15 scheduler, based on the conforming cell number and the non-conforming cell number of said CBR class bandwidth management section and each of said class bandwidth management sections.

20 25 The input buffering switch comprising:

a class information allocation section;

a CBR class bandwidth management section;

K class bandwidth management sections (K is a positive integral that is one or more);

25 a connection request generation section; and

a cell read-out controlling section,

wherein said class information allocation section
allocates received class information of each cell to one
class bandwidth management section of said class bandwidth

5 management sections, and

wherein said CBR class bandwidth management section
measures the cell number of a CBR class, and

wherein, based on the received class information, said
class bandwidth management sections determine conformance
10 or non-conformance cell by cell, and measure the
conforming cell number or non-conforming cell number for
each class, and

wherein, based on the cell number of the conforming cell
in said CBR class bandwidth management section and each of
15 said class bandwidth management sections, and the total
number of the non-conforming cell of each class, said
connection request generation section generates connection
request to a switch scheduler, and

wherein said cell read-out controlling section is a
20 section that, based on the conforming cell number and the
non-conforming cell number of said CBR class bandwidth
management section and each of said class bandwidth
management sections, decides which cells are to be read
out when connection permission was received from said
25 switch scheduler.

26 The input buffering switch comprising:
 a class information allocation section;
 a CBR class bandwidth management section;
5 K class bandwidth management sections (K is a positive
integral that is one or more);
 a connection request generation section; and
 a cell read-out controlling section,
 wherein said class information allocation section
10 allocates received class information of each cell to one
class bandwidth management section out of said class
bandwidth management sections, and
 wherein said CBR class bandwidth management section
measures the cell number of a CBR class, and
15 wherein, based on the received class information, said
class bandwidth management sections determine conformance
or non-conformance cell by cell, and measure the
conforming cell number or non-conforming cell number by
classes, and
20 wherein, based on the total number of the conforming
cell and the total number of the non-conforming cell of
each class including said CBR class, said connection
request generation section generates connection request to
a switch scheduler, and
25 wherein said cell read-out controlling section is a

section that, based on the conforming cell number and the non-conforming cell number of said CBR class bandwidth management section and each of said class bandwidth management sections, decides which cells are to be read out when connection permission was received from said switch scheduler, and

wherein said cell read-out controlling section is a section that selects the cells to be sent in order of the cell of said CBR class, the conforming cell, and the non-conforming cell.

27 The input buffering switch comprising:
a specialized class for a CBR traffic; and
a connection request generation section that makes connection request for a switch scheduler, which can execute three-step priority control, characterized in that said connection request generation section makes connection request of said specialized class for a CBR traffic prior to the connection request of the other classes for said switch scheduler.

28 The input buffering switch comprising:
a first specialized class for a CBR traffic;
a second class for the other traffics than the CBR traffic;

a cell read-out controlling section that reads out the cells from each of said classes; and

a connection request generation section that makes connection request for a switch scheduler, which can
5 execute two-step priority control, characterized in that, when said connection request generation section received connection request from said switch scheduler, said cell read-out controlling section is a section that reads out the cells from said first class prior to said second class.

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29 A controlling method of a virtual output queuing controlling device comprising:

a first step of allocating received class information of each cell to one of a plurality of class bandwidth
15 management sections;

a second step of measuring the cell number of a CBR class;

a third step of, based on the received class information, determining conformance or non-conformance cell by cell to
20 measure the conforming cell number and the non-conforming cell number by classes;

a fourth step of, based on said cell number of the CBR class, the total number of the conforming cell of each class, and the total number of the non-conforming cell of
25 each class, generating connection request to a switch

scheduler; and

a fifth step of, based on the conforming cell number and the non-conforming cell number in said CBR class bandwidth management section and each of said class bandwidth

5 management sections, deciding which cells are to be read out when connection permission was received from said switch scheduler.

30 The controlling method of the virtual output queuing
10 controlling device according to claim 29, characterized in that said fifth step comprises the steps of:

in the event that either of the conforming cell or the non-conforming cell was included in the received CBR class, selecting said CBR class; and

15 subtracting one from the count number of the conforming cell number in said CBR class.

31 The controlling method of the virtual output queuing
controlling device according to claim 29, characterized in
20 that said fourth step comprises the steps of:

in the event that said CBR class was received, adding the cell number of said CBR class;

in the event that the cell number of said CBR class exceeded a predetermined value, notifying connection
25 request with a first priority to said switch scheduler;

and

subtracting only said predetermined value from the cell number of said CBR class.

5 32 The controlling method of the virtual output queuing controlling device according to claim 29, characterized in that:

10 said third step comprises the step of, in the event that the said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth portion is one or more, adding the conforming cell number and the total conforming cell number in its class; and

said fourth step comprising the steps of:

15 in the event that said total conforming cell number exceeded a predetermined value, notifying connection request with a second priority to said switch scheduler; and

subtracting only said predetermined value from said total conforming cell number.

20

33 The controlling method of the virtual output queuing controlling device according to claim 29, characterized in that:

25 said third step comprises the step of, in the event that the said CBR class was not received, and yet that a

remaining credit of a guaranteed bandwidth portion is below one, adding the non-conforming cell number and the total non-conforming cell number in its class; and

said fourth step comprising the steps of:

5 in the event that said total non-conforming cell number exceeded a predetermined value, notifying connection request with a third priority to said switch scheduler; and

10 subtracting only said predetermined value from said total non-conforming cell number.

34 The controlling method of the virtual output queuing controlling device according to claim 29, characterized in that, in said fifth step, the cells to be sent are
15 selected in order of the cell of said CBR class, the conforming cell and the non-conforming cell.

35 A controlling method of a virtual output queuing controlling device comprising:

20 a first step of allocating received class information of each cell to one of a plurality of class bandwidth management sections;

 a second step of measuring the cell number of a CBR class;

25 a third step of, based on the received class information,

determining conformance or non-conformance cell by cell to measure the conforming cell number and the non-conforming cell number by classes;

5 a fourth step of, based on the total number of the conforming cell of said CBR class and each of said class bandwidth management sections, and the total number of the non-conforming cell of each class, generating connection request to a switch scheduler; and

10 a fifth step of, based on the conforming cell number and the non-conforming cell number in said CBR class bandwidth management section and each of said class bandwidth management sections, deciding which cells are to be read out when connection permission was received from said switch scheduler.

15

36 The controlling method of the virtual output queuing controlling device according to claim 35, characterized in that said fifth step comprises the steps of:

20 in the event that either of the conforming cell or the non-conforming cell was included in the received CBR class, selecting said CBR class; and

subtracting one from the count number of the conforming cell number in said CBR class.

25 37 The controlling method of the virtual output queuing

controlling device according to claim 35, characterized in that said fourth step comprises the steps of:

in the event that said CBR class was received, adding the cell number of said CBR class;

5 in the event that the cell number of said CBR class exceeded a predetermined value, notifying connection request with a first priority to said switch scheduler; and

10 subtracting only said predetermined value from the cell number of said CBR class.

38 The controlling method of the virtual output queuing controlling device according to claim 35, characterized in that:

15 said third step comprises the step of, in the event that the said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth portion is one or more, adding the conforming cell number and the total number of the conforming cell in its class; and

20 said fourth step comprising the steps of:

in the event that said total conforming cell number exceeded a predetermined value, notifying connection request with a first priority to said switch scheduler; and

25 subtracting only said predetermined value from said

total conforming cell number.

39 The controlling method of the virtual output queuing
controlling device according to claim 35, characterized in
5 that:

said third step comprises the step of, in the event that
the said CBR class was not received, and yet that a
remaining credit of a guaranteed bandwidth portion is
below one, adding the non-conforming cell number and the
10 total non-conforming cell number in its class; and

said fourth step comprising the steps of:

in the event that said total non-conforming cell
number exceeded a predetermined value, notifying
connection request with a second priority to said switch
15 scheduler; and

subtracting only said predetermined value from said
total non-conforming cell number.

40 The controlling method of the virtual output queuing
20 controlling device according to claim 35, characterized in
that, in said fifth step, the cells to be sent are
selected in order of the cell of said CBR class, the
conforming cell and the non-conforming cell.

41 A controlling method of a virtual output queuing
controlling device comprising:

a first step of allocating received class information of
each cell to one of a plurality of class bandwidth

5 management sections;

a second step of measuring the cell number of a CBR
class;

a third step of, based on the received class information,
determining conformance or non-conformance cell by cell to
10 measure the conforming cell number and the non-conforming
cell number by classes;

a fourth step of, based on the total number of the
conforming cell and the total number of the non-conforming
cell of each class including said CBR class, generating
15 connection request to a switch scheduler; and

a fifth step of, based on the conforming cell number and
the non-conforming cell number in said CBR class bandwidth
management section and each of said class bandwidth
management sections, deciding which cells are to be read
20 out when connection permission was received from said
switch scheduler,

wherein, in said fifth step, the cells to be sent are
selected in order of the cell of said CBR class, the
conforming cell and the non-conforming cell.

42 The controlling method of the virtual output queuing
controlling device according to claim 41, characterized in
that said fifth step comprises the steps of:

in the event that either of the conforming cell or the
5 non-conforming cell was included in the received CBR class,
selecting said CBR class;

in the event that said CBR class is a class that
includes the conforming cell, subtracting one from the
count number of the conforming cell number; and

10 in the event that said CBR class is a class that
includes the non-conforming cell, subtracting one from the
count number of the non-conforming cell number.

43 The controlling method of the virtual output queuing
15 controlling device according to claim 41, characterized in
that said fifth step comprises the steps of:

in the event that the conforming cell was included in
the received CBR class, selecting said CBR class; and

subtracting one from the count number of the conforming
20 cell number in said CBR class.

44 The controlling method of the virtual output queuing
controlling device according to claim 41, characterized in
that said fourth step comprises the step of:

25 in the event that the said CBR class was received,

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adding the cell number of said CBR class;

in the event that the cell number of said CBR class
exceeded a predetermined value, notifying connection
request with a first priority to said switch scheduler;

5 and

subtracting only said predetermined value from said cell
number of the CBR class.

45 The controlling method of the virtual output queuing
10 controlling device according to claim 41, characterized in
that:

said third step comprises the step of, in the event that
the said CBR class was not received, and yet that a
remaining credit of a guaranteed bandwidth portion is one
15 or more, adding the conforming cell number and the total
conforming cell number in its class; and

said fourth step comprising the steps of:

in the event that said total conforming cell number
exceeded a predetermined value, notifying connection
20 request with a second priority to said switch scheduler;
and

subtracting only said predetermined value from said
total conforming cell number.

25 46 The controlling method of the virtual output queuing

controlling device according to claim 45, characterized in that:

said third step comprises the step of, in the event that the said CBR class was not received, and yet that a

5 remaining credit of a guaranteed bandwidth portion is below one, adding the non-conforming cell number and the total non-conforming cell number in its class; and

said fourth step comprising the steps of:

10 in the event that said total non-conforming cell number exceeded a predetermined value, notifying connection request with a third priority to said switch scheduler; and

subtracting only said predetermined value from said total non-conforming cell number.

15

47 A program for causing a computer to function as:

a CBR class bandwidth management section that measures the cell number of a CBR class;

20 at least one class bandwidth management section that, based on received class information, determines conformance or non-conformance cell by cell to measure the conforming cell number and the non-conforming cell number by classes;

25 a class information allocation section that allocates the received class information of each cell to one class

bandwidth management section out of said class bandwidth management sections:

based on the cell number of said CBR class, the total number of the conforming cell of each class, and the total
5 number of the non-conforming cell of each class, a connection request generation section that generates connection request to a switch scheduler; and

when connection permission was received from said switch scheduler, based on said CBR class bandwidth management
10 section and each of said class bandwidth management sections, a cell read-out controlling section that decides which cells are to be read out.

48 The program according to claim 47, characterized in
15 that said cell read-out controlling section is a section that:

in the event that either of the conforming cell or the non-conforming cell was included in the received CBR class, selects said CBR class; and

20 subtracts one from the count number of the conforming cell number in said CBR class.

49 The program according to claim 47, characterized in
25 that said connection request generation section is a section that:

in the event that said CBR class was received, adds the cell number of said CBR class;

in the event that said cell number of the CBR class exceeded a predetermined value, notifies connection
5 request with a first priority to said switch scheduler;
and

subtracts only said predetermined value from the cell number of said CBR class.

10 50 The program according to claim 47, characterized in that:

said class bandwidth management section is a section that:

in the event that said CBR class was not received, and
15 yet that a remaining credit of a guaranteed bandwidth portion is one or more, adds the conforming cell number and the total conforming cell number in its class; and

said connection request generation section is a section that:

20 in the event that said total conforming cell number exceeded a predetermined value, notifies connection request with a second priority to said switch scheduler;
and

subtracts said only predetermined value from said total
25 conforming cell number.

51 The program according to claim 47, characterized in
that:

5 said class bandwidth management section is a section
that, in the event that said CBR class was not received,
and yet that a remaining credit of a guaranteed bandwidth
portion is below one, adds the non-conforming cell number
and the total non-conforming cell number in its class; and
said connection request generation section is a section
10 that:
in the event that said total non-conforming cell
number exceeded a predetermined value, notifies
connection request with a third priority to said switch
scheduler; and
15 subtracts only said predetermined value from said
total non-conforming cell number.

52 The program according to claim 47, characterized in
that said cell read-out controlling section is a section
20 that selects the cells to be sent in order of the cell of
said CBR class, the conforming cell and the non-conforming
cell.

53 A program for causing a computer to function as:
25 a CBR class bandwidth management section that measures

the cell number of a CBR class;

at least one class bandwidth management section that,
based on received class information, determines
conformance or non-conformance cell by cell to measure the
5 conforming cell number and the non-conforming cell number
by classes;

a class information allocation section that allocates
the received class information of each cell to one class
bandwidth management section out of said class bandwidth
10 management sections:

a connection request generation section that, based on
the total number of the conforming cell of said CBR class
bandwidth management section and each of class bandwidth
management sections, and the total number of the non-
15 conforming cell of each class, generates connection
request to a switch scheduler; and

a cell read-out controlling section that, based on the
conforming cell number and the non-conforming cell number
of said CBR class bandwidth management section and each of
20 said class bandwidth management sections, decides which
cells are to be read out when connection permission was
received from said switch scheduler.

54 The program according to claim 53, characterized in
25 that said cell read-out controlling section is a section

that:

in the event that either of the conforming cell or the non-conforming cell was included in the received CBR class, selects said CBR class; and

5 subtracts one from the count number of the conforming cell number in said CBR class.

55 The program according to claim 53, characterized in that said connection request generation section is a
10 section that:

in the event that said CBR class was received, adds the conforming cell number of said CBR class;

in the event that said total conforming cell number exceeded a predetermined value, notifies connection
15 request with a first priority to said switch scheduler;
and

subtracts only said predetermined value from said total conforming cell number.

20 56 The program according to claim 53, characterized in that:

said class bandwidth management section is a section that, in the event that said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth
25 portion is one or more, adds the conforming cell number

and the total conforming cell number in its class; and
said connection request generation section is a section
that:

in the event that said total conforming cell number
5 exceeded a predetermined value, notifies connection
request with a first priority to said switch scheduler;
and

subtracts only said predetermined value from said
total conforming cell number.

10

57 The program according to claim 53, characterized in
that:

said class bandwidth management section is a section
that, in the event that said CBR class was not received,
15 and yet that a remaining credit of a guaranteed bandwidth
portion is below one, adds the non-conforming cell number
and the total non-conforming cell number in its class; and
said connection request generation section is a section
that:

20 in the event that said total non-conforming cell
number exceeded a predetermined value, notifies
connection request with a second priority to said switch
scheduler; and

subtracts only said predetermined value from said
25 total non-conforming cell number.

58 The program according to claim 53, characterized in
that said cell read-out controlling section is a section
that selects the cells to be sent in order of the cell of
5 said CBR class, the conforming cell and the non-conforming
cell.

59 A program for causing a computer to function as:
a CBR class bandwidth management section that measures
10 the cell number of a CBR class;
at least one class bandwidth management section that,
based on received class information, determines
conformance or non-conformance cell by cell to measure the
conforming cell number and the non-conforming cell number
15 by classes;
a class information allocation section that allocates
the received class information of each cell to one class
bandwidth management section out of said class bandwidth
management sections:
20 a connection request generation section that, based on
the total number of the conforming cell and the total
number of the non-conforming cell of each class including
said CBR class, generates connection request to a switch
scheduler; and
25 a cell read-out controlling section that, based on the

conforming cell number and the non-conforming cell number
in said CBR class bandwidth management section and each of
said class bandwidth management sections, selects the
cells to be read out in order of the cell of said CBR
5 class, the conforming cell and the non-conforming cell
when connection permission was received from said switch
scheduler.

60 The program according to claim 59, characterized in
10 that said cell read-out controlling section is a section
that:

in the event that either of the conforming cell or the
non-conforming cell was included in the received CBR class,
selects said CBR class;

15 in the event that said CBR class is a class that
includes the conforming cell, subtracts one from the count
number of the conforming cell number; and

in the event that said CBR class is a class that
includes the non-conforming cell, subtracts one from the
20 count number of the non-conforming cell number.

61 The program according to claim 59, characterized in
that said cell read-out controlling section is a section
that:

25 in the event that the conforming cell was included in

the received CBR class, selects said CBR class; and
subtracts one from the count number of the conforming
cell number in said CBR class.

5 62 The program according to claim 59, characterized in
that said connection request generation section is a
section that:

in the event that said CBR class was received, adds the
cell number of said CBR class;

10 in the event that the cell number of said CBR class
exceeded a predetermined value, notifies connection
request with a first priority to said switch scheduler;
and

subtracts only said predetermined value from the cell
15 number of said CBR class.

63 The program according to claim 59, characterized in
that:

said class bandwidth management section is a section
20 that, in the event that said CBR class was not received,
and yet that a remaining credit of a guaranteed bandwidth
portion is one or more, adds the conforming cell number
and the total conforming cell number in its class; and

said connection request generation section is a section
25 that:

in the event that said total conforming cell number exceeded a predetermined value, notifies connection request with a second priority to said switch scheduler; and

5 subtracts only said predetermined value from said total conforming cell number.

64 The program according to claim 59, characterized in that:

10 said class bandwidth management section is a section that, in the event that said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth portion is below one, adds the non-conforming cell number and the total non-conforming cell number in its class; and

15 said connection request generation section is a section that:

in the event that said total non-conforming cell number

exceeded a predetermined value, notifies connection request with a third priority to said switch scheduler; and

subtracts only said predetermined value from said total non-conforming cell number.

25 65 A program for causing a computer to execute a

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controlling method of a virtual output queuing controlling device comprising:

a first step of allocating received class information of each cell to one of a plurality of class bandwidth

5 management sections;

a second step of measuring the cell number of a CBR class;

a third step of, based on the received class information, determining conformance or non-conformance cell by cell to
10 measure the conforming cell number and the non-conforming cell number by classes;

a fourth step of, based on said cell number of the CBR class, the total number of the conforming cell of each class, and the total number of the non-conforming cell of
15 each class, generating connection request to a switch scheduler; and

a fifth step of, based on the conforming cell number and the non-conforming cell number in said CBR class bandwidth management section and each of said class bandwidth
20 management sections, deciding which cells are to be read out when connection permission was received from said switch scheduler.

66 The program according to claim 65, characterized in
25 that said fifth step comprises the steps of:

in the event that either of the conforming cell or the non-conforming cell was included in the received CBR class, selecting said CBR class; and

subtracting one from the count number of the conforming
5 cell number in said CBR class.

67 The program according to claim 65, characterized in that said fourth step comprises the steps of:

in the event that said CBR class was received, adding
10 the cell number of said CBR class;

in the event that the cell number of said CBR class exceeded a predetermined value, notifying connection request with a first priority to said switch scheduler; and

15 subtracting only said predetermined value from the cell number of said CBR class.

68 The program according to claim 65, characterized in that:

20 said third step comprises the step of:

in the event that the said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth portion is one or more, adding the conforming cell number and the total conforming cell number in its class; and

25 said fourth step comprising the steps of:

in the event that said total conforming cell number exceeded a predetermined value, notifying connection request with a second priority to said switch scheduler; and

5 subtracting only said predetermined value from said total conforming cell number.

69 The program according to claim 65, characterized in that:

10 said third step comprises the step of, in the event that the said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth portion is below one, adding the non-conforming cell number and the total non-conforming cell number in its class; and

15 said fourth step comprising the steps of:

in the event that said total non-conforming cell number exceeded a predetermined value, notifying connection request with a third priority to said switch scheduler; and

20 subtracting only said predetermined value from said total non-conforming cell number.

70 The program according to claim 65, characterized in that, in said fifth step, the cells to be sent are
25 selected in order of the cell of said CBR class, the

conforming cell and the non-conforming cell.

- 71 A program for causing a computer to execute a
controlling method of a virtual output queuing controlling
5 device comprising:
- a first step of allocating received class information of
each cell to one of a plurality of class bandwidth
management sections;
 - a second step of measuring the cell number of a CBR
10 class;
 - a third step of, based on the received class information,
determining conformance or non-conformance cell by cell to
measure the conforming cell number and the non-conforming
cell number by classes;
 - 15 a fourth step of, based on the total number of the
conforming cell in said CBR class and each of said class
bandwidth management sections, and the total number of the
non-conforming cell of each class, generating connection
request to a switch scheduler; and
 - 20 a fifth step of, based on the conforming cell number and
the non-conforming cell number in said CBR class bandwidth
management section and each of said class bandwidth
management sections, deciding which cells are to be read
out when connection permission was received from said
25 switch scheduler.

72 The program according to claim 71, characterized in that said fifth step comprises the steps of:

in the event that either of the conforming cell or the
5 non-conforming cell was included in the received CBR class, selecting said CBR class; and

subtracting one from the count number of the conforming cell number in said CBR class.

10 73 The program according to claim 71, characterized in that said fourth step comprises the step of:

in the event that the said CBR class was received, adding the cell number of said CBR class;

in the event that said total conforming cell number
15 exceeded a predetermined value, notifying connection request with a first priority to said switch scheduler; and

subtracting only said predetermined value from said total conforming cell number.

20

74 The program according to claim 71, characterized in that:

said third step comprises the step of, in the event that the said CBR class was not received, and yet that a
25 remaining credit of a guaranteed bandwidth portion is one

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or more, adding the conforming cell number and the total conforming cell number in its class; and

said fourth step comprising the steps of:

in the event that the total said total conforming cell
5 number exceeded a predetermined value, notifying
connection request with a first priority to said switch
scheduler; and

subtracting only said predetermined value from said
total conforming cell number.

10

75 The program according to claim 71, characterized in
that:

said third step comprises the step of, in the event that
the said CBR class was not received, and yet that a
15 remaining credit of a guaranteed bandwidth portion is
below one, adding the non-conforming cell number and the
total non-conforming cell number in its class; and

said fourth step comprising the steps of:

in the event that said total non-conforming cell
20 number exceeded a predetermined value, notifying
connection request with a second priority to said switch
scheduler; and

subtracting only said predetermined value from said
total non-conforming cell number.

25

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76 The program according to claim 71, characterized in that, in said fifth step, the cells to be sent are selected in order of the cell of said CBR class, the conforming cell and the non-conforming cell.

5

77 A program for causing a computer to a controlling method of a virtual output queuing controlling device comprising:

a first step of allocating received class information of each cell to one of a plurality of class bandwidth management sections;

a second step of measuring the cell number of a CBR class;

a third step of, based on the received class information, determining conformance or non-conformance cell by cell to measure the conforming cell number and the non-conforming cell number by classes;

a fourth step of, based on the total number of the conforming cell and the total number of the non-conforming cell of each class including said CBR class, generating connection request to a switch scheduler; and

a fifth step of, based on the conforming cell number and the non-conforming cell number in said CBR class bandwidth management section and each of said class bandwidth management sections, selecting the cells to be read out in

order of the cell of said CBR class, the conforming cell, and the non-conforming cell when connection permission was received from said switch scheduler.

5 78 The program according to claim 77, characterized in that said fifth step comprises the steps of:

in the event that either of the conforming cell or the non-conforming cell was included in the received CBR class, selecting said CBR class;

10 in the event that said CBR class is a class that includes the conforming cell, subtracting one from the count number of the conforming cell number; and

in the event that said CBR class is a class that includes the non-conforming cell, subtracting one from the
15 count number of the non-conforming cell number

79 The program according to claim 77, characterized in that said fifth step comprises the steps of:

in the event that the conforming cell was included in
20 the received CBR class, selecting said CBR class; and

subtracting one from the count number of the conforming cell number in said CBR class.

80 The program according to claim 77, characterized in
25 that said fourth step comprises the step of:

in the event that the said CBR class was received,
adding the cell number of said CBR class;

in the event that the cell number of said CBR class
exceeded a predetermined value, notifying connection
5 request with a first priority to said switch scheduler;
and

subtracting only said predetermined value from the cell
number of said CBR class.

10 81 The program according to claim 77, characterized in
that:

said third step comprises the step of, in the event that
the said CBR class was not received, and yet that a
remaining credit of a guaranteed bandwidth portion is one
15 or more, adding the conforming cell number and the total
conforming cell number in its class; and

said fourth step comprising the steps of:

in the event that said total conforming cell number
exceeded a predetermined value, notifying connection
20 request with a second priority to said switch scheduler;
and

subtracting only said predetermined value from said
total conforming cell number.

25 82 The program according to claim 73, characterized in

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that:

said third step comprises the step of, in the event that the said CBR class was not received, and yet that a remaining credit of a guaranteed bandwidth portion is
5 below one, adding the non-conforming cell number and the total non-conforming cell number in its class; and

said fourth step comprising the steps of:

in the event that said total non-conforming cell number exceeded a predetermined value, notifying
10 connection request with a third priority to said switch scheduler; and

subtracting only said predetermined value from said total non-conforming cell number.

15 83 A record medium that stored program, which a computer can read out, said program for causing a computer to function as:

a CBR class bandwidth management section that measures the cell number of a CBR class;

20 at least one class bandwidth management section that, based on received class information, determines conformance or non-conformance cell by cell to measure the conforming cell number and the non-conforming cell number by classes;

25 a class information allocation section that allocates

the received class information of each cell to one class bandwidth management section out of said class bandwidth management sections:

based on the cell number of said CBR class, the total
5 number of the conforming cell of each class, and the total number of the non-conforming cell of each class, a connection request generation section that generates connection request to a switch scheduler; and

when connection permission was received from said switch
10 scheduler, based on said CBR class bandwidth management section and each of said class bandwidth management sections, a cell read-out controlling section that decides which cells are to be read out.

15 84 A record medium that stored program, which a computer can read out, said program for causing a computer to function as:

a CBR class bandwidth management section that measures the cell number of a CBR class;

20 at least one class bandwidth management section that, based on received class information, determines conformance or non-conformance cell by cell to measure the conforming cell number and the non-conforming cell number by classes;

25 a class information allocation section that allocates

the received class information of each cell to one class bandwidth management section out of said class bandwidth management sections:

5 a connection request generation section that, based on the total number of the conforming cell of said CBR class bandwidth management section and each of class bandwidth management sections, and the total number of the non-conforming cell of each class, generates connection request to a switch scheduler; and

10 a cell read-out controlling section that, based on the conforming cell number and the non-conforming cell number of said CBR class bandwidth management section and each of said class bandwidth management sections, decides which cells are to be read out when connection permission was
15 received from said switch scheduler.

85 A record medium that stored program, which a computer can read out, said program causing a computer to function as:

20 a CBR class bandwidth management section that measures the cell number of a CBR class;

at least one class bandwidth management section that, based on received class information, determines conformance or non-conformance cell by cell to measure the
25 conforming cell number and the non-conforming cell number

by classes;

a class information allocation section that allocates the received class information of each cell to one class bandwidth management section out of said class bandwidth

5 management sections:

a connection request generation section that, based on the total number of the conforming cell and the total number of the non-conforming cell of each class including said CBR class, generates connection request to a switch

10 scheduler; and

a cell read-out controlling section that, based on the conforming cell number and the non-conforming cell number in said CBR class bandwidth management section and each of said class bandwidth management sections, selects the

15 cells to be read out in order of the cell of said CBR class, the conforming cell and the non-conforming cell when connection permission was received from said switch scheduler.

20 86 A record medium that stored program, which a computer can read out, said program for causing a computer to execute a controlling method of a virtual output queuing controlling device comprising:

a first step of allocating received class information of
25 each cell to one of a plurality of class bandwidth

management sections;

a second step of measuring the cell number of a CBR class;

a third step of, based on the received class information,
5 determining conformance or non-conformance cell by cell to
measure the conforming cell number and the non-conforming
cell number by classes;

a fourth step of, based on said cell number of the CBR
class, the total number of the conforming cell of each
10 class, and the total number of the non-conforming cell of
each class, generating connection request to a switch
scheduler; and

a fifth step of, based on the conforming cell number and
the non-conforming cell number in said CBR class bandwidth
15 management section and each of said class bandwidth
management sections, deciding which cells are to be read
out when connection permission was received from said
switch scheduler.

20 87 A record medium that stored program, which a
computer can read out, said program for causing a computer
to execute a controlling method of a virtual output
queuing controlling device comprising:

a first step of allocating received class information of
25 each cell to one of a plurality of class bandwidth

management sections;

a second step of measuring the cell number of a CBR class;

a third step of, based on the received class information,
5 determining conformance or non-conformance cell by cell to
measure the conforming cell number and the non-conforming
cell number by classes;

a fourth step of, based on the total number of the
conforming cell in said CBR class and each of said class
10 bandwidth management sections, and the total number of the
non-conforming cell of each class, generating connection
request to a switch scheduler; and

a fifth step of, based on the conforming cell number and
the non-conforming cell number in said CBR class bandwidth
15 management section and each of said class bandwidth
management sections, deciding which cells are to be read
out when connection permission was received from said
switch scheduler.

20 88 A record medium that stored program, which a
computer can read out, said program for causing a computer
to a controlling method of a virtual output queuing
controlling device comprising:

a first step of allocating received class information of
25 each cell to one of a plurality of class bandwidth

management sections;

a second step of measuring the cell number of a CBR class;

a third step of, based on the received class information,
5 determining conformance or non-conformance cell by cell to
measure the conforming cell number and the non-conforming
cell number by classes;

a fourth step of, based on the total number of the
conforming cell and the total number of the non-conforming
10 cell of each class including said CBR class, generating
connection request to a switch scheduler; and

a fifth step of, based on the conforming cell number and
the non-conforming cell number in said CBR class bandwidth
management section and each of said class bandwidth
15 management sections, selecting the cells to be read out in
order of the cell of said CBR class, the conforming cell,
and the non-conforming cell when connection permission was
received from said switch scheduler.